

Supporting the Growing Needs of the GIS Industry

Remotely sensed imagery collected from orbiting satellites and airborne platforms is playing a vital role in a society driven by a constant need for information. The value of these images rises even more when geospatial features such as buildings, roads, and vegetation are automatically extracted and stored in a geographic information systems (GIS) database to support natural resource, urban, and military planning applications.

Monitoring changes in the Earth's environment from space has long been a primary focus for NASA, but now local, state, and Federal Government agencies, as well as private industry, are increasingly turning to commercial, high-resolution satellite imagery as a source of information to support GIS applications. Nevertheless, a bottleneck exists in this information flow from space that is associated with inflated labor costs and the time required to manually extract geospatial features from digital imagery.

Visual Learning Systems, Inc. (VLS), of Missoula, Montana, has developed a commercial software application called Feature Analyst® to address this logjam. Feature Analyst was conceived under a **Small Business Innovation Research (SBIR)** contract with NASA's Stennis Space Center, and through the Montana State University TechLink Center, an organization funded by NASA and the U.S. Department of Defense to link regional companies with Federal laboratories for joint research and technology transfer. The software provides a paradigm shift to automated feature extraction, as it utilizes spectral, spatial, temporal, and ancillary information to model the feature extraction process; presents the ability to remove clutter; incorporates advanced machine learning techniques to supply unparalleled levels of accuracy; and includes an exceedingly simple interface for feature extraction.

Feature Analyst leverages the natural ability of humans to recognize objects in complex scenes, and does not require the user to explain the human-visual process in an algorithmic form. Since the system does not require programming knowledge, users with little computational knowledge can effectively create automated feature extraction (AFE) models for the tasks under consideration. It offers three levels of automation with its AFE models: the first creates a small training set, explicitly sets up the learning parameters (such as the spatial association settings), and produces an AFE model that is then applied to the remainder of the image; the second creates AFE models that can be shared and then fine-tuned, with a few training examples, for a particular



feature extraction program; and the final level of automation involves batch classification, which categorizes imagery with an existing AFE model or set of models. The latter level is considered "full automation," where features are extracted without human interaction.

Other than extraction of single features, Feature Analyst offers many tools for easily creating multi-class extractions, including change detection, three-dimensional feature extraction, data fusion, unsupervised classification, and advanced clean-up and post-processing. With a wealth of options, a user can segment an image into numerous classes, such as water, low- and high-vegetation, and structure.

The U.S. National Imagery and Mapping Agency and the U.S. Forest Service have each completed extensive testing and evaluation of the Feature Analyst with regard to the speed and accuracy of its extraction capabilities. The National Imagery and Mapping Agency concluded that the evaluation of the Feature Analyst software shows substantial benefits for the development of geospatial data from imagery. In one particular assessment, the extraction of land cover and drainage features from commercial satellite imagery was performed approximately five times faster with Feature Analyst than with a standard manual extraction system. While the objective testing concentrated on relatively small scenes, a review of the Feature Analyst's performance over larger regions suggests that the potential time savings in a production setting could be as much as a factor of 100, depending on the homogeneity of the region.



From image to map: Feature Analyst® extracts object-specific, land-cover, and land-use features from satellite and airborne imagery to support the fast-growing GIS industry.

The U.S. Forest Service is currently using the program to map fires and distinguish between burned and unburned foliage, while the U.S. Border Patrol is using it to map trails along national borders. Other areas of utilization include environmental mapping for hazardous waste and oil spill monitoring and cleanup, and transportation planning/asset management for airport runways, wetlands, roads, guard rails, and curbs.

In March of 2003, VLS and Environmental Systems Research Institute, Inc. (ESRI), a global leader in the development of commercial GIS software, signed a strategic agreement that allows ESRI to market and resell Feature Analyst. The pact focuses on solutions for defense and intelligence, homeland security, and environmental, educational, and local government GIS markets.

“Feature Analyst provides a very valuable solution for our users,” said Rich Turner, product manager of ESRI’s ArcGIS™ software. “Satellite imagery and high-resolution aerial photography are becoming more accessible, not to mention cheaper and more reliable. With a

product such as Feature Analyst, our users can better leverage the benefits of imagery as a valuable source of information during the construction and maintenance of their GIS databases.” Dr. David Opitz, the chief executive officer of VLS, concurs, adding that the partnership “joins together the market leader in GIS with what is arguably the hottest new product in the remote sensing and GIS industries.”

Feature Analyst 3.2 for ArcGIS and another ESRI product, ArcView,™ includes the advanced feature extraction and image classification techniques developed by VLS during the collaboration with NASA, and with additional research from the U.S. Department of Defense.

Feature Analyst is now helping NASA in its critical mission to accelerate and automate the identification and classification of features in digital satellite imagery to support its Earth Science Enterprise mission.

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